ROYAL ASTRONOMICAL SOCIETY.

VOL. XVI. *November* 9, 1855. No. 1.

M. J. JOHNSON, Esq. President, in the Chair.

John Cockle, Esq. M.D., 107 Guildford Street, Russell Square, was balloted for and duly elected a Fellow of the Society.

Account of Recent Astronomical Operations in Russia.

(*Extract of a Letter from M. Otto Struve to the Astronomer Royal, dated Oct.* 21, 1855.)

"When I last wrote you, I said that galvanic telegraphy was quite in its infancy in Russia. Since then the war has prompted that affair in a rapid manner. At this moment we have already in Russia about 6000 miles, or even more, of galvanic wires, and are on one side through Warsaw and Cracow; on the other side, through Königsberg, in connexion with the foreign lines. But to make use of these lines for scientific purpos ... hardly be possible before the close of the war, for at present all the lines are continually used for official despatches. Only one short line has served for scientific objects,—this is the line of Petersburgh to Cronstadt, by which I have to transmit regularly exact Pulkowa time to that part for the purpose of regulating the rates of the chronometers of our navy. This is a small part of the duties devolved upon me by a new appointment as Consultative Astronomer to the Admiralty, in the same manner as I was already since 1848 engaged with the Imperial General Staff. By this supplementary appointment, the geographical part of my sphere of activity has considerably increased, and consequently I am yet more limited than before in the pure scientific astronomical pursuits.

"It is really remarkable that the war until now has not exercised the least influence on the progress of any scientific pursuit for which the support of government is wanted. On the contrary, the energy elicited by the state of war in one principal direction has given rise also to a development of energy in many other respects. This will be proved in part by a short enumeration of the principal geographical undertakings, in the arrangement or direction of which we had to take a part this year. First started from here a numerous party, under the direction of Mr. Schwarz, for the exploration of Eastern Siberia; another party was sent to the Steppes of the Kirghis; a third, under personal direction of Döllen, had to fix the exact geographical positions of a large number of points situated in or near the Ural Mountains, to form a base for the construction of an exact topographical map of the vast districts of mines in that part of Russia; a fourth

expedition, provided with forty chronometers, has to join, first, Moscow with Saratow; and then, this latter town with Astrachan; and, finally, the great trigonometrical operations in the southern part of Russia and in the Transcaucasian provinces are carried on without the least interruption. From the last-mentioned circumstance you will conclude that on our part both the astronomical and the geodetical part of a great arc of parallel will be finished in a very short time.

"In my astronomical pursuits the parallaxes of fixed stars have taken a prominent part during the last year, and I think I have made a considerable progress in these researches. Now that the methods of observations are entirely fixed, I am quite sure that if there is a difference of parallax of 0″·1 between any couple of stars situated at a distance less than 5′ from another, four observations made at the epochs of maxima and minima will be entirely sufficient to prove its existence and to define its amount within very narrow limits. I have not yet calculated exactly other parallaxes besides those of *α Lyræ* and 61 *Cygni*, the general results of which are known to you, but a short review of my observations shows that *μ Cassiopeiæ* has a parallax of more than 0″·3, *η Cassiopeiæ* of more than 0″·2, and *Capella* of between 0″·1 and 0″·2. For all these cases, the results obtained by the angles of position agree remarkably with those furnished by the distances.

"The observations of other stars, namely, of *α Tauri*, *α Aquilæ*, *α Andromedæ*, and *α Cassiopeiæ*, are about to be closed; but to guard me against any preoccupation, not even the first step has been made for the reduction of these observations."

The Positions of 20 Polar Stars, as determined at Redhill.
By R. C. Carrington, Esq.

In the belief that the publication of the positions of an increased number of polar stars suitable for the determination of the meridian error and polar-point circle-reading of a meridian instrument, may be of general utility, I somewhat anticipate the future appearance of the catalogue I have in progress, and give at once the values I now possess, and am satisfactorily applying at Redhill.

The places here given are the result of a careful discussion of 612 observations taken (simultaneously in each element) between the months of December 1853 and April 1855 inclusive. Of these, the older established stars *α*, *δ* and *λ Ursæ Minoris*, and 51 *Cephei*, appropriate 326, leaving 286 observations to the remaining 16, the numbers of observations of which individually range from 9 to 28. The constants used in their reduction are those given by Peters in his *Num. Const. Nut.* Terms of the second order were omitted, but the small terms which have for argument twice the moon's longitude, were applied throughout. The epoch is the instant at which the sun's mean longitude was 280° near the beginning of the year 1855.

	R.A.	N.P.D.		R.A.	N.P.D.
	h m s	° ′ ″		h m s	° ′ ″
...	.....	.....	12	12 14 22·10	1 29 46·8
1	0 45 30·70	1 45 23·9	...	.....	.....
Pol.	1 6 31·20	1 27 48·8	...	.....	.....
...	.....	.....	13	13 12 10·50	1 34 26·2
3	2 30 34·50	2 2 53·0	...	.....	.....
...	.....	.....	14	15 25 59·70	2 13 9·4
4	3 52 25·10	4 50 7·5	...	.....	.....
...	.....	.....	15	16 6 34·95	4 17 20·0
5	5 15 59·15	4 53 35·0	...	.....	.....
6	5 48 0·40	3 14 26·6	...	.....	.....
...	.....	.....	δ	18 19 6·85	3 24 0·6
51 C	6 31 6·60	2 44 51·3	...	.....	.....
8	7 3 39·60	0 58 10·3	...	.....	.....
...	.....	.....	λ	20 8 29·90	1 7 27·4
...	.....	.....	18	21 27 40·75	3 34 15·9
9	9 47 45·20	2 0 37·5	...	.....	.....
...	.....	.....	19	22 30 46·20	2 39 23·7
10	10 52 57·50	1 34 29·3	...	.....	.....
...	.....	.....	20	23 27 49·50	3 29 32·4
11	11 57 21·80	3 36 32·5	...	.....	.....

It would too much increase the length of this communication for me to explain fully the process of discussion which has led to the positions at present adopted, but one phenomenon of observation presented itself in the course of it which I am desirous to state, as it may possibly prove to be the discovery of a source of discordance not hitherto noticed. The circumstance to which I allude is, that observations of those polar stars which are visible in daylight require (in my own case, at least), when observed in daylight, a sensible correction in both elements before they are comparable with observations taken by night, and consequently that an azimuth error, or a latitude deduced from observations of a star alternately above and below the pole, not so corrected, will generally be in error.

It is my practice, in reducing transits, to use the formula

$$c \cdot \frac{1}{15} \cdot \operatorname{cosec} \delta + m \cdot \frac{1}{15} \cdot \operatorname{cotan} \delta + n$$

The collimators provide the means of always keeping the collimation error c so small, that for the region I am working upon the residual amount may be neglected as collimation error, and merged with m the meridian error, given by observation; the constant n being lumped with clock-error.

Now when the separate values of m and of the polar-point circle-reading deduced from each star were arranged, as in the table for the latter part of August 1855, given below, it immediately became apparent, after a first approximation to the finally-adopted mean positions, that the corrections I have mentioned would be required, and that they held good with a degree of consistent uniformity which could hardly have been expected.

The mean of 36 daylight observations of *Polaris* gave an

excess over night values of $-1''\cdot3$ in m, and of $+1''\cdot4$ in p. For δ *Urs. Min.* 24 obs. gave $-0''\cdot8$ in m, and $+0''\cdot9$ in p. For 51 *Ceph.* 19 obs. gave $-0''\cdot9$ in m, and $+0''\cdot9$ in p. The discrepant signs among the values were very few.

In practice I consequently now apply to all values of m and p deduced from daylight observations of *Polaris*, the corrections $+1''\cdot3$ and $-1''\cdot3$ respectively, and for δ *Urs. Min.* and 51 *Ceph.* $+0''\cdot9$ and $-0''\cdot9$.

We may, perhaps, have some difficulty in deciding between two possible sources of this discordance. Either we may suspect that the excess in m indicates that the instrument has a diurnal variation of position arising from the action of temperature, and that the excess in p indicates the necessity of some correction to the refraction-table used; or, secondly, we may suspect that both excesses arise from difference of optical circumstances.

In the case of my own transit-circle the annual range of m appears, from the exact observations of two years, to be about 9 seconds, the greatest + values being reached at the beginning of March, and the greatest − values at the end of August; and so far the signs would agree with the idea of the difference arising from variation of temperature. But, on the other hand, the amount of these excesses of m derived from observations made at very different hours in the day, and at times when the diurnal range of temperature, has been very different, will not support the notion. Further, an inspection of the series of values of m deduced from frequently as many as 6, 8, and 10 stars in one night, during which the thermometer will have progressively fallen 10° or 15°, does not appear either to support the notion, there being as many nights exhibiting no progression of value as of those which may, perhaps, be thought to do so.

I am accordingly inclined, till I have better grounds for forming an opinion, to lean to the second of the possible causes before named, partly from one hypothesis in that case meeting both discordances, partly because I think this view rather supported by the brighter star *Polaris* requiring so sensibly different corrections from the fainter ones, and partly because small discrepancies thus originated are not altogether unknown to us, as might be illustrated by the history of the restoration of the standard yard.

Should this view be supported hereafter, we may, perhaps, find these corrections added to the list of personal equations.

I somewhat regret that the observations in which I am now engaged do not admit at present of my making such new arrangements as would facilitate the immediate settlement of this doubtful point, and that I have to content myself with recommending it to the consideration of those who are engaged in exact meridional astronomy.

I shall be glad if the present statement should lead any other observer to communicate anything from his experience which may elucidate the subject.

In the following table, which is added partly in explanation of

a previous allusion, and partly to give confidence in the use of the published positions of the 20 stars, the asterisk against a star's number indicates that it was observed below the pole; the column *w* shows the number of wires over which the star was observed in R.A.; the column *t* gives the seconds resulting from time of passing mean wire + correction for clock-error + reduction to 1855·0; the column *f* contains the factors $\frac{1}{15}$ · cotan δ; the column *d* gives the number of seconds by which the seconds in column *t* are less than the adopted right ascensions; the column *m* contains the separate values of the corrections for meridian error found by dividing *d* by *f* for each star. The column *p* contains, in like manner, the seconds of the circle-reading of the polar-point given by each star. These circle-readings result from the use of a single pair of microscopes, usually read by Mr. Simmonds, but read on the 26th and 31st of August by Mr. Carrington.

1855.	Star.	*w.*	*t.*	*f.*	*d.*	*m.*	Apply.	*p.*	Apply.
			s		s	″	° ′ ″		
Aug. 21	δ	5	13·56	+1·123	− 6·71	−6·0	359 56	54·9	
	51 C*	5	58·84	−1·388	+ 7·76	−5·6	———	54·1	
	8*	3	17·09	−3·930	+22·51	−5·8		53·5	
	λ	3	51·84	+3·402	−21·94	−6·5		53·4	
							″		
	11*	5	15·85	−1·057	+ 5·95	−5·6	−5·9	54·6	54·1
26	8*	3	18·61	−3·929	+20·99	−5·4		54·4	
	λ	5	47·83	+3·405	−17·93	−5·3		53·2	
	9*	3	33·77	−1·897	+11·43	−6·0		54·1	
	19	3	54·89	+1·437	− 8·69	−6·0		54·4	
	10*	1	46·62	−2·424	+10·88	−4·5	−5·5	54·8	54·3
28	δ	5	13·08	+1·123	− 6·23	−5·6		55·3	
	51 C*	5	59·36	−1·388	+ 7·24	−5·2		55·0	
	8*	3	21·28	−3·929	+18·32	−4·7		54·6	
	λ	5	46·76	+3·405	−16·86	−4·9		54·5	
	20	4	55·77	+1·093	− 6·27	−5·8	−5·2	54·3	54·7
29	8*	3	22·66	−3·929	+16·94	−4·3		55·0	
	λ	5	45·14	+3·405	−15·24	−4·5		54·1	
	20	2	55·90	+1·093	− 6·40	−5·9		54·8	
	11*	5	17·23	−1·057	+ 4·57	−4·3	−4·6	54·3	54·6
30	8*	3	21·93	−3·929	+17·67	−4·5		55·2	
	λ	5	44·16	+3·405	−14·26	−4·2		55·7	
	9*	5	34·69	−1·897	+10·51	−5·6		54·4	
	12*	1	12·04	−2·552	+10·06	−4·0	−4·7	55·1	55·0
31	8*	3	26·81	−3·929	+12·79	−3·3		54·8	
	λ	5	42·25	+3·405	−12·35	−3·6		54·1	
	18	3	45·92	+1·070	− 5·15	−4·8		54·7	
	11*	2	17·83	−1·057	+ 3·97	−3·8	−4·0	54·1	54·5

Note.—A comparison of the mean errors of single values of *m*, given by stars of different polar distance, does not lead to a preference of one star over another on account of its polar distance, within the limits of those contained in the present list.

Remarks upon certain Cases of Personal Equation which appear to have hitherto escaped notice, accompanied with a Table of Results. By the Astronomer Royal.

"My valued friend, Mr. Sheepshanks, in the course of his micrometrical comparisons of standards *à traits*, discovered (what I believe had never before been suspected,) that when the defining-lines of a standard of length are placed under two micrometer-microscopes, and the moveable wires of the micrometer are made to coincide with the images of these lines, different observers place the micrometer-wires in different positions; and that the difference is not the same with different standard-bars; so that in the micrometrical comparisons of two standards *à traits* there is a personal equation peculiar to each observer. Although the origin of this is very obscure, yet the circumstance that different microscopes are employed for the two ends seems to leave an opening for an explanation: although I am not in any way prepared to say how it can sufficiently account for the discordance observed.

"Mr. Dunkin, however, has lately pointed out to me a case of personal equation which appears more difficult to explain, where the same microscope is used for observing both divisions, namely, in measuring the interval between two adjacent divisions of a graduated circle for the ordinary correction for runs. The phenomenon is so singular that I think it may be worthy of the attention of the Society.

"Mr. Dunkin first discovered this peculiarity in the estimation of the correction for runs of the horizontal circle of the Alta-zimuth. As the illuminating light is carried there in the observer's hand, I thought it possible that the mode of holding the lamp might account for the difference. I therefore requested Mr. Dunkin to collect in a digested form the observations for the Transit Circle in which the illuminators are fixed, and in which the magnifying power of the microscopes is so great as to give considerable certainty on the instrumental results. These observations (at least their first results) are contained in the table which I now lay before the Society. The number exhibited is the correction for a measure of 100″: it ought to be multiplied by 3 and to have its sign changed, in order to give the apparent excess of the space of 5′ on the limb above a certain definite measure in the micrometer-microscope. The observers are Mr. Henry, Mr. Dunkin, Mr. Henderson, Mr. Ellis, Mr. Todd, and Mr. Criswick: all acute and experienced observers. The observations are so intermixed, in regard of time, that no peculiarity of season or other circumstance that I can discover will account for the difference.

"It will be seen that in each of three years the correction on 100″ found by Mr. Henry exceeds that found by Mr. Dunkin by about one-eighth of a second. The correction found by Mr. Ellis was at first nearly the same as that of Mr. Dunkin; but in later years Mr. Ellis's numbers have approximated more to Mr. Henry's.

"I subjoin the table, containing the whole of the individual Corrections for Runs, from which these conclusions are drawn.

G. B. AIRY.

"*Royal Observatory, Greenwich,*
"1855, *November* 21.

Comparison of the Observations for Correction for Runs of Micro scopes of Transit Circle, arranged according to observers.

Month and Day.	Correction for 100″ deduced from the Observations for Correction for Runs of Microscopes of Transit Circle.			
	H.	D.	J. H.	E.
1853.				
Jan. 3	... ...	+0·288		
10	... ...	... ...	+0·347	
17	+0·381			
31	... ...	0·246		
Feb. 7	... ...	... ...	0·350	
14	0·323			
21				
28	... ...	0·246		
March 7	... ...	... ...	0·534	
14	0·427			
21				
28				
April 4				
11	0·340			
18				
25	... ...	0·322		
May 2	... ...	... ...	0·473	
9	0·301			
16	... ...	0·280		
23	... ...	... ...	0·427	
30	0·479			
June 6	... ...	... ...	... ...	+0·246
13	... ...	0·340		
20	... ...	... ...	0·288	
27	0·483			
July 4	... ...	... ...	... ...	0·187
11	... ...	0·361		
18	... ...	... ...	0·357	
25	0·503			
Aug. 1	... ...	... ...	... ...	0·316
8	... ...	0·253		
15	... ...	... ...	0·587	
22	... ...	... ...	... ...	0·378
29	0·448			
Sept. 5	... ...	... ...	... ...	0·295
12	... ...	0·472		
19	... ...	... ...	0·427	
26	... ...	... ...	... ...	0·385
Oct. 3	0·475			

Month and Day.	Correction for 100″ deduced from the Observations for Correction for Runs of Microscopes of Transit Circle.			
	H.	D.	J. H.	E.
1853.				
Oct. 10	... ...	+0·340		
17	... ...	... ...	+0·417	
24	... ...	... ...	... ...	+0·315
31	+0·406			
Nov. 7	... ...	0·284		
14	... ...	... ...	0·406	
21	... ...	... ...	... ...	0·240
28	0·381			
Dec. 5	0·510			
12	... ...	0·288		
19	... ...	... ...	0·323	
28	... ...	... ...	... ...	0·350
Mean ...	+0·420	+0·310	+0·411	+0·301
1854.				
Jan. 2	0·132			
9	... ...	0·184		
16		... ...	0·305	
23		... ...	... ...	0·360
30	0·333			
Feb. 6	... ...	0·277		
13	... ...	... ...	0·343	
20	... ...	... ...	... ...	0·350
27	0·264			
March 6	... ...	0·354		
13	... ...	... ...	0·406	
21	... ...	... ...	... ...	0·253
27	0·336			
April 10	... ...	... ...	0·455	
17	... ...	... ...	... ...	0·295
24	0·455			
May 1	... ...	0·385		
8	... . .	... ...	... ...	0·486
15	... ...	... ...	... ...	0·465
29	0·284			
June 5	... ...	... ...	... ...	0·500
12	... ...	0·291		
19	... ...	... ...	... ...	0·350
26	... ...	... ...	... ...	0·357

Month and Day.	Correction for 100″ deduced from the Observations for Correction for Runs of Microscopes of Transit Circle.			
	H.	D.	E.	T.
1854.				
July 4	... ...	... ...	... ...	+0·263
10	... ...	... ...	+0·489	
17	+0·514			
24	... ...	+0·343		
31	... ...	... ...	... ...	0·378
Aug. 7	... ...	... ...	0·448	
14	0·611			
21	... ...	0·284		
28	... ...	... ...	... ...	0·250
Sept. 4	0·442			
11	... ...	... ...	0·361	
18	... ...	0·264		
25	0·517			
Oct. 2	... ...	... ...	... ...	0·395
9	0·497			
16	... ...	... ...	... ...	0·424
23	0·455			
30	... ...	... ...	0·372	
Nov. 6	... ...	... ...	... ...	0·319
13	0·399			
20	... ...	... ...	0·222	
27	... ...	0·177		
Dec. 4	... ...	... ...	... ...	0·257
11	... ...	... ...	0·350	
18	... ...	0·177		
27	... ...	... ...	0·222	
Mean ...	+0·403	+0·274	+0·368	+0·329
1855.				
Jan. 1	0·486			
8	0·392			
15	... ...	... ...	... ...	0·274
22	... ...	0·167		
29	... ...	... ...	0·264	
Feb. 5	0·157			
12	... ...	0·135		
19	0·194			
26	... ...	... ...	0·347	
March 5	0·428			

Month and Day.	Correction for 100″ deduced from the Observations for Correction for Runs of Microscopes of Transit Circle.			
	H.	D.	E.	C.
1855.				
March 12	... ...	+0·108		
19	+0·455			
26	... ...	... ...	... ...	+0·507
April 2	... ...	... ...	... ...	0·236
9	... ...	... ...	+0·465	
16	0·395			
23	... ...	... ...	... ...	0·326
30	. . ...	... ...	0·347	
May 7	0·500			
14	... ...	0·347	... ...	0·240
28	... ...	... ...	0·271	
June 4	0·663			
11	... ...	... ...	... ...	0·316
18	... ...	0·323		
25	... ...	... ...	0·412	
July 2	... ...	... ...	... ...	0·170
9	0·431			
16	... ...	... ...	0·378	
30	... ...	0·458		
Aug. 6	... ...	... ...	... ...	0·204
13	... ...	... ...	0·513	
20	0·497			
27	... ...	0·497		
Sept. 7	... ...	... ...	... ...	0·402
10	... ...	... ...	0·462	
17	0·445			
24	... ...	0·340		
Oct. 1	... ...	... ...	... ...	0·243
8	... ...	... ...	0·472	
15	... ...	0·298		
22	... ...	... ...	... ...	0·319
30	... ...	... ...	0·562	
Nov. 7	... ...	... ...	... ...	0·229
Mean ...	+0·420	+0·297	+0·408	+0·290

Assemblage of Means.

	H.	D.	J. H.	E.	T.	C.
1853	0·420	0·310	0·411	0·301		
1854	0·403	0·274	... ...	0·368	0·329	
1855	0·420	0·297	... ...	0·408	... ...	0·290

On the Theory of Astronomical Refractions.

By Sir John W. Lubbock, Bart. F.R.S.*

In the year 1840 the author of this paper investigated the subject of Astronomical Refractions upon a different hypothesis of the constitution of the atmosphere from that assumed by preceding inquirers, and instituted a comparison between the results and the corresponding refractions inserted in the *Connaissance des Temps*, as well as those of Ivory and Bessel. The present communication, besides embodying the substance of his researches on that occasion, contains also some additional remarks and comparisons tending to elucidate more fully his previous labours.

The following table exhibits the constitution of the atmosphere, which the author was induced to adopt as the basis of his investigation:—

Height in Miles.	Pressure *p*. Inches.	Temperature *τ*. Fahr.	Density *ϱ*.
0	30·00	+ 50·0	1·00000
1	24·61	35·0	·84611
2	20·07	19·5	·71294
3	16·25	+ 3·4	·59798
4	13·06	− 13·3	·49903
5	10·41	30·6	·41403
10	2·81	126·4	·14499
15	·45	240·6	·03573
22·35	...	−448·0	...

We extract the following remarks:—

"Ivory, in his paper on refractions published in the *Philosophical Transactions* for 1838, instituted a comparison between the result of his theory and Bessel's table; and in p. 224 of that paper a table is given offering a comparison between the table of the *Conn. des Temps*, his own, and Bessel's. When afterwards, in the year 1840, I endeavoured to give a solution of this problem, assuming an atmosphere differently constituted from that of Ivory, and, in my opinion, nearer the truth, I also published the table, in p. 133, giving a similar comparison, and I took for Bessel's refractions those given as such by Ivory. It was not until very recently that I perceived that Ivory had altered all Bessel's figures by adding to the logarithm of the refraction according to Bessel, a constant quantity. As Ivory's description of the nature of this alteration appears to me to be somewhat obscure, I applied to Mr. Adams for his opinion, and he writes to me thus: 'Ivory's object, in his comparative table of refractions, is to compare the *laws of variation* of the refraction corresponding to different theories as to the constitution of the atmosphere, and not the *absolute amount* of the refraction, which will, of course, depend upon the assumed refractive power of air of a given density. For

* This communication is inserted at full length in vol. xxiv. of the *Memoirs* of the Society.

this purpose he increases the logarithms of the refractions given in Bessel's table, by the constant ·00507, in order to make the refraction at Z.D. 45° agree with his own value. According to Bessel himself the logarithm to be added to the quantity in table 1, in order to reduce the state of barometer and thermometer supposed by Ivory, would be ·00412 or ·00095 less than before; but this only indicates that Bessel supposes the refractive power of air, under given circumstances, to be slightly less than Ivory takes it. The latter assumes this refractive power to be the same as that on which the French tables are based, and consequently the quantities in these tables are rendered comparable with his own by merely adding to these logs. the constant ·00115, which is the difference of the log. of 29·921 inch. and 30 inch. in the heights of the barometer supposed in the two cases respectively.'

"Ivory regarded, and I think truly, that Bessel's refractions were to be considered as resulting from, and agreeing with, observation, and therefore as affording the best test which he could obtain of the accuracy of his own views touching the constitution of the atmosphere. That they are employed in the reduction of the *Greenwich Observations* shows the value which is attached to them by the Astronomer Royal.

"The value of the refraction at 45° apparent zenith distance of Bessel, as given by Ivory, is 58″·36, but the true value is 58″·23; this difference is so small that without recalculating my expressions, which would involve a very serious amount of labour, the proper figures may be obtained, owing to the manner in which the constant depending on the refractive power of air enters into this expression by subtracting from the refraction, as given in my former table, a small quantity proportioned to it. In this manner the first column of the following table has been formed. The second column has been calculated by me from the tables contained in the *Greenwich Observations* for 1853, recently issued, the argument being the apparent zenith distance for barometer 30 inch. and 50° Fahrenheit. The third column was calculated by me from the tables formed upon Laplace's theory, and given in the *Conn. des Temps* for 1851, by M. Caillet. At low altitudes these tables give greater refractions than Bessel's, but the table of errors which Bessel gives in the *Fundamenta*, p. 53, seems to indicate that his refractions are too great near the horizon. The fourth column gives the refractions, which would obtain, calculated from Laplace's expressions, if the refraction at 45° was made to agree with Bessel's, that is, they are the numbers in col. 3 multiplied by $\frac{58''\cdot23}{58''\cdot39}$. But it must be recollected that astronomers who reduce their observations by means of M. Caillet's tables use those given in col. 3.

"My expression for the refraction, barometer 30 inch. and Fahrenheit 50°, is as follows, the coefficients of my former expression being multiplied by $\frac{58''\cdot23}{58''\cdot36}$:

$$\text{Ref.} = \sin\theta \left\{ 1130''\cdot3\, e + 636''\cdot8\, e^3 + 219''\cdot9\, e^5 + 60''\cdot4\, e^7 + 17''\cdot8\, e^9 + 5'''\cdot5\, e^{11} + \&c. \right\}$$

"When θ is the apparent zenith distance, $e = \tan \frac{\varphi}{2}$

$$\tan \varphi = \frac{[9{\cdot}01398\,14]}{\cos \theta}$$

"This expression gives for the horizontal refraction 2070″·7. Ivory says that there is great probability that the horizontal refraction is very near 2070″, and does not exceed that quantity.

"Groombridge, who made many observations for the purpose of determining the amount of the refraction near the horizon, makes the horizontal refraction for barometer 30 inch., and thermometer Fahrenheit 50°, 2075″·4, which is exactly the horizontal refraction furnished in my expression in p. 134.

"It may be concluded that the refractions which belong to the atmosphere, constituted as I have supposed, in conformity with my theory of the heat of steam and other vapours, are consistent with observation.

Mean Refractions for the Temperature 50 *Fahrenheit and Barometric Pressure* 30 *Inches.*

App. Zen. Dist.	Lubbock. 1855.	Bessel.	Conn. des Temps.	Conn. des Temps, alt^{d}.	App. Zen. Dist.
10°	10″·28	10″·28	10″·31	10″·28	10°
20	21·21	21·21	21·27	21·21	20
30	33·65	34·65	33·74	33·65	30
40	48·88	48·88	49·01	48·88	40
45	58·23	58·23	58·39	58·23	45
50	69·36	69·36	69·56	69·37	50
55	83·06	83·06	83·29	83·06	55
60	100·62	100·62	100·77	100·49	60
65	124·35	124·34	124·70	124·36	65
70	158·81	158·76	159·23	158·79	70
75	214·20	214·10	214·78	214·19	75
80	319·37	319·16	320·23	319·35	80
85	591·81	591·99	591·70	590·07	85
86	704·46	705·40			86
87	862·27	862·49			87
88	1094·76	1098·70			88

"As Table V. is not carried beyond 85° in the *Conn. des Temps*, I calculated from Bessel's tables the refractions for 86°, 87°, and 88°, for Fahrenheit 50°, and barometer 29·921, in order to compare them with those given by M. Caillet for those conditions in Table VI., *Conn. des Temps*, 1851, p. 58.

	Bessel.	Conn. des Temps.	Conn. des Temps, alt^{a}.
86	703·63	708·80	706·85
87	860·26	868·73	866·35
88	1095·80	1103·09	1100·07

Dr. Drew exhibited a series of astronomical diagrams, representing various celestial objects, such as the phases of the planets, the craters in the moon, clusters of stars, nebulæ, &c., executed from the drawings of Mr. De La Rue, Lord Rosse, Sir John Herschel, and other original sources, and adapted to the lecture-room. The nebulæ and double-stars were depicted on a blue ground, which produced a pleasing effect.

Note on Comet II. 1855. By Dr. Donati.

In this Note Dr. Donati first gives parabolic elements of Comet II. 1855, and then assigns elliptic elements which he deduced from four positions of the comet by the aid of a method recently devised by Mossotti. The following are the positions which served as the basis of calculation; they are reduced to the mean equinox of Jan. 1, 1855, and corrected for aberration and parallax:—

Florence M.T.	R.A.	Decl.
	° ′ ″	° ′ ″
1855, Jan. 3·41956	100 17 2·8	+36 19 42·0
5·44491	107 49 57·1	36 15 48·9
11·42931	121 9 45·1	34 39 36·1
17·41726	127 23 38·8	+33 2 16·1

From these positions the following elliptical elements were deduced:—

Passage of the Perihelion, 1855, May 30·232563 Florence M.T.

Longitude of the Ascending Node.....	260 ° 15 ′ 7·3 ″	Mean Equinox, 1855·0.
Longitude of the Perihelion	282 54 12·7	
Inclination	156 52 51·6	
Perihelion Distance.....	0·5678239	
Excentricity.....	0·9909006	

whence

Semi-major Axis	62·40234
Time of Revolution.....	492·95 years.

"The inclination greater than 90° indicates that the heliocentric motion of the comet is *retrograde*. Employing the usual mode of distinction we should have

	°	′	″
Longitude of the Perihelion	237	36	1·9
Inclination	23	7	8·4

"The following is a comparison between the positions calculated from the foregoing elliptic elements and the fundamental positions employed in computing the orbit:—

	Obs.—Theory. R.A.	Decl.
	″	″
June 3	−5·2	−5·9
5	+9·8	+6·4
11	+1·4	−2·1
17	+1·8	+0·9

"After having obtained these results, I searched in the Catalogue of Comets contained in Delambre's Astronomy with the view of ascertaining whether 493 years back (conformably to the ellipse which I deduced) a comet had pursued a path similar to that of Comet II. of the present year; and I was surprised to find that precisely in the year 1362 a comet had appeared, the motion of which was *retrograde*, and for which Burckhardt had calculated the following two orbits:—

Orbit I.

Passage of the Perihelion, 1362, March 11·208 Paris M.T.

Longitude of the Ascending Node	249°
Longitude of the Perihelion	219
Inclination	21
Perihelion Distance	0·4558

Orbit II.

Passage of the Perihelion, 1362, March 2·333 Paris M.T.

Longitude of the Ascending Node	237°
Longitude of the Perihelion	227
Inclination	32
Perihelion Distance	0·4700

"These two orbits may be considered as the limits of the true orbit described by the Comet of 1362, of which merely gross observations were made.

"If we institute a comparison between the elements of Comet II. of this year and those of the Comet of 1362, we shall find that the two orbits sufficiently resemble each other.

"It must be borne in mind, however, that the orbit of the Comet of 1362 is uncertain, and that, if I have obtained for the second Comet of 1855 a period of 493 years, this result cannot be

considered as an absolute determination, since the small arc through which it has been possible to observe the comet may easily be made to coincide with ellipses of widely different excentricities.

"However, the coincidence of the period and the resemblance of the two orbits appear to me to render it, if not absolutely certain, at least extremely probable, that the second Comet of 1855 is identical with that of 1362."

Elements of Fides. By M. George Rümker.

(*Communicated by Professor Challis.*)

M	322 17 40·3	1855, Nov. 0·0 G.M.T.	
ϖ	63 26 6·9	Mean equinox, Jan. 0·0 1856.	
Ω	8 8 56·2		
i	3 11 43·6		
φ	8 22 25·8		
Log a ...	0·415680		
Log μ ...	2·966487		

These elements were computed from observations at Bilk, Oct. 6; Berlin, Oct. 23; and Hamburg, Nov. 2 and 13.

On certain Appearances connected with the Zodiacal Light. By Baron Humboldt.*

"In Gould's valuable American *Astronomical Journal* (No. lxxxiv., May 26, 1855), there appears a letter from the Rev. Mr. Jones, chaplain of the frigate Mississippi, containing, as the result of his observations of the Zodiacal Light in the seas of China and Japan, the conjecture of a second radiating ring of light having a relation to the moon. This conjecture is founded upon the *extraordinary spectacle of the Zodiacal Light simultaneously observed at both east and west horizons from eleven to one o'clock*, during several days in succession. As I observed something analogous fifty-two years ago in the Southern Ocean during the voyage of forty days from Callao, in Peru, to the port of Acapulco in Mexico, and have given only a very brief account of it in the astronomical part of my *Cosmos*, it may not be uninteresting to the members of the Academy if I laid before them an extract from my French Journal, written at sea, relating to this phenomenon, which hitherto has not formed the subject of any detailed remarks. The Zodiacal Light, and the difficult question whether we ought to attribute to a physical cause existing beyond our atmosphere the remarkable variations of light which it undergoes, while in tropical nights the smallest stars exhibit the same brightness to the naked eye, were

* Monatsbericht der Kön. Preuss. Akademie der Wissenschaften, Juli, 1855.

subjects which engaged my attention during a period of five years upon great heights among the Cordilleras, in the extensive plains or Llanos, at sea, and on both sides of the equator, as will be seen by reference to my partly published correspondence with Olbers (*Cosmos*, vol. i. p. 412.) From my ship-journal I extract the following observations, extending from the 14th to the 19th of March, 1803, between north latitude 12° 9′ and 15° 20′, and chronometrical longitude 104° 27′ and 105° 46′ west of Paris.

"On the 17th and 18th of March the Zodiacal Light, the base of which appeared to rest upon the sun, shone with a brightness which I had never seen on any former occasion of the approach of the vernal equinox. The luminous pyramid terminated between *Aldebaran* and the *Pleiades* at an apparent altitude of 39° 5′ measured above the sea-horizon, which was still sufficiently visible. The vertex was somewhat inclined towards the north; and the direction of the brightest part appeared by the compass to be west-north-west. What has struck me most during this voyage, is the great regularity with which, during five or six nights in succession, the brightness of the Zodiacal Light progressively increased and diminished. Its existence was hardly discernible during the first three-quarters of an hour after sunset, although the darkness was sufficiently great to render visible the stars of the fourth and fifth magnitude; but after $7^h\ 15^m$ the luminous spindle appeared at once in all its beauty. Its colour was not white, like that of the milky way, but a reddish yellow, as Dominique Cassini assures us he had seen it in Europe. Very small clouds, situated accidentally towards the horizon, reflected upon the reddish ground a lively blue light. One would almost suppose he saw a second sunset in the west. About ten o'clock the light entirely disappeared; at midnight I perceived only a feeble trace of it, although the celestial vault still exhibited the same degree of transparency. *While the light was very bright in the west, we constantly perceived in the east (and this is beyond doubt a very striking phenomenon) a whitish light, which was also of a pyramidal form. The latter augmented the brightness of the sky in a very striking manner. Even the sailors were delighted with this double light in the west and the east; and I am inclined to think that this white light in the east was the reflexion of the real Zodiacal Light at setting. Both also disappeared at the same time.* Analogous reflexions frequently present themselves in our climates at sunset, but I should never have imagined that the brightness of the zodiacal light could be sufficiently strong to repeat itself by the simple reflexion of the rays. All these luminous appearances were almost the same from the 14th to the 19th of March. We did not see the Zodiacal Light on the 20th and 21st of March, *although the nights were beautiful in the highest degree.*"

These are the words of my ship-journal, containing my observations, and also the thoughts which they suggested at the time to my mind. It was in reference to what I had written down in an

unpublished ship-journal on the occasion of a voyage in the Southern Ocean, about the beginning of the present century, that, five years previous to the publication of the interesting observations of the Rev. Mr. George Jones, I made the following statement in the astronomical part of *Cosmos*:—

"On the whole the variations of the Zodiacal Light appear to me to depend upon variations inherent in the phenomenon, upon the greater or less intensity of the luminous processes going on in the ring. This is proved by my observations in the Southern Ocean, which indicated an opposite light in the heavens similar to that seen at sunset." (*Cosmos*, vol. iii. p. 589.)

I may remark further that I have been surprised at the increased brightness of the Zodiacal Light upon ascending to great altitudes. This was observable upon the lofty peaks of the Cordilleras 10,000 or 12,000 feet high; also in Mexico, in January 1804, at altitudes of only 7000 feet; and from the Cloister of Mount Cenis, where I remained with Gay Lussac several nights (in March 1805) at an altitude of 6350 feet, for the purpose of determining the intensity of the magnetic force during very intense cold, and ascertaining the quantity of oxygen contained in the atmosphere. It was, consequently, seen both in tropical and in temperate latitudes. But the variations in the brightness of the phenomenon cannot, according to my experience, be accounted for solely by the constitution of our atmosphere. There remains much still to be observed relative to this subject.

The following is a copy of the letter to which Baron Humboldt refers:—

(*From the Rev. George Jones, U.S.N. to the Editor of the Astronomical Journal, Cambridge, U.S.*)

"In my recent cruise in the U.S. steam-frigate Mississippi, chiefly in the China and Japan seas, but taking us also around the globe, I had excellent opportunities for observation of the Zodiacal Light. This light, you know, appears to the best advantage within the tropics, where it stretches upward to a great elevation, and is a remarkable object; but it is also very desirable to observe it in high latitudes; and in this also I was favoured, as our voyaging extended from 41° north to 53° south latitude; and in some instances our transitions, for weeks together, were very rapid, thus giving me opportunities for observing whether any parallax could be made or not.

"I was also fortunate enough to be twice near the latitude of 23° 28′ north, when the sun was at the opposite solstice, in which position the observer has the ecliptic, at midnight, at right angles with his horizon, and bearing east and west. Whether the latter circumstance affected the result or not I cannot say; but I then had the extraordinary spectacle of the Zodiacal Light, simultaneously at both east and west horizons, from 11 to 1 o'clock, for several nights in succession.

"In the first part of our cruise my observations were of a

desultory character; but I soon began to see the necessity of great precision, and accordingly constructed star-charts from a celestial globe (a small but excellent one) that happened to be on board, which charts I afterwards had cut in wood at Canton; and thus I was furnished with materials for accurately recording all the changes of this phenomenon, not only in successive nights, but also in the successive hours of the same night. My rule was, to draw on my charts the boundaries of the Zodiacal Light as exhibited among the stars, with such annotations as the case required; then, again, do the same after an interval of an hour or half-hour; and so to continue, generally as long as the boundaries could be made out reliably; then, if the morning admitted it, to resume observations at the earliest possible hour, and so to proceed until the dawn. I have thus, in many instances, observations for every hour of the night.

"At an early period I began to query whether the moon, when near its full, might not give a Zodiacal Light: and at last, when I had gained more experience in observing, and in the peculiar character of this light, I was able to get, at different periods, fourteen reliable observations of what I think must be considered a Zodiacal Light produced by the moon. I have also two records of a distinct Zodiacal Light produced by the joint action of the sun and moon, *i. e.* at the hour when the moon, then near its first quartering, was about 65° above the western horizon; the reflexion from the combined light of the sun and moon being sufficient to overpower the moonlight proper, and thus to produce a decided stream of light in the sky within the Zodiacal-Light boundaries. The latter of these observations was the more remarkable, inasmuch as the moon was then *without* the boundary of this joint reflected light.

"You will excuse my prolixity in stating these varieties of observation, for the conclusion from all the data in my possession is a startling one. It seems to me that these data can be explained only by the supposition of a nebulous ring with the earth for its centre, and lying within the orbit of the moon. This conclusion seems to evolve itself, — 1st, from the simultaneous midnight east and west observations, which preclude the possibility of a ring around the sun *within* the earth's orbit; 2dly, from the great hourly lateral changes (often semi-hourly) in the boundaries of the Light, caused by the observer's change of place, in that time, as regards the ecliptic or axis of the Zodiacal Light, which lateral change in the Light is too great to allow of our considering it at a distance of 170,000,000 of miles, as its lower end would be, near dawn, if it is a ring around the sun and beyond the earth's orbit; and 3dly, from the moon's Zodiacal Light, if real, which I think it is. That it is a ring, the unbroken continuity of my observations satisfactorily determines. For more than two years, I never failed to see this Light, evening and morning, when the moon and clouds did not interfere; and, except one evening, I have continuous records of this kind.

"I could get no parallax; but, on the contrary, as we went south, the boundaries of the Zodiacal Light changed with us to the south among the stars; and so, *vice versâ*, towards the north, caused, doubtless, by the ring's presenting new portions of its wide reflecting surface to the sun's light.

"GEORGE JONES,
"Chaplain U.S. Navy."

Brooklyn, May 17, 1855.

Description of New or Improved Instruments for Navigation and Astronomy. Exhibited at the Paris Universal Exposition of 1855, by C. Piazzi Smyth, Astronomer Royal for Scotland, Professor of Practical Astronomy in the University of Edinburgh. Edinburgh: June, 1855.

The instruments described in this *brochure* are arranged in four distinct classes: viz. 1. Instruments of navigation; 2. Instruments of nautical astronomy; 3. Instruments of terrestrial astronomy; 4. Instruments of cosmical astronomy. The total number of instruments described is twenty. We extract the following description of an instrument which is classed under the head of Cosmical Astronomy:—

"No. 18. *Edinburgh Equatoreal, Universal.*—In all the equatoreally mounted telescopes intended for transportation to and employment in various latitudes, *i.e.* in all with which I have yet had the fortune to meet, there has invariably been this feature of awkwardness; viz. that the centre of gravity of the instrument was not coincident with the centre of the arc for latitude adjustment, and was, indeed, considerably removed from it.

"Hence it arose that when one of these portable equatoreals, constructed to suit the latitude of London, was transported to the Cape of Good Hope, and had its polar axis sloped to suit the lower position there of the celestial pole, the centre of the weight of the instrument was in consequence thrown so far beyond the centre of the support, as to make it dangerously unsteady, or even incapable of standing.

"The present equatoreal is accordingly devised to meet this difficulty, by having the centre of gravity of telescope, polar axis, and, in short, the whole instrument, accurately concentric with the arc for the latitude adjustment. By this method it is brought about, that the equatoreal can be adjusted to suit either a polar or an equatoreal latitude, without any disturbance of the equilibrium of the stand.

"The little instrument exhibited may be regarded as a model of a large one, with certain proportions altered; but it was specially constructed for actual use with the naked eye, in observations of the zodiacal light and the courses of shooting stars."

An Introduction to Practical Astronomy, with a Collection of Astronomical Tables. By Elias Loomis, LL.D., Professor of Mathematics and Natural Philosophy in the University of the City of New York. New York, 1855.

The object of this work is to provide amateurs of astronomy, individuals engaged in astronomical expeditions and Government surveys, &c. &c., with a manual containing an explanation of the methods generally employed in the ordinary class of astronomical computations. The various processes are illustrated by a copious collection of examples, and a series of tables is given to facilitate the labours of the computer. It may be remarked that the work is very lucidly drawn up and that a due regard to practical utility is visible in every page.

Results of Astronomical Observations made at the Observatory of Harvard College, under the Direction of William Crouch Bond, A.M. (Zone Catalogue of 5500 *Stars, situated between the Equator and* 0° 20′ *North Declination, observed during the Years* 1852–3), *Cambridge, U.S.*, 1855.

In an Introduction extending to ninety-seven pages the author gives a complete description of the instrumental means, and of the methods of observation and reduction, employed in these observations. The plan of observation adopted for the zones contained in this volume includes the determination of the right ascension and declination of all stars from the equator to 0° 20′ of north declination to the eleventh magnitude, and as many of the twelfth as could be conveniently observed in their passage without interfering with the observation of brighter stars; the position of each has been twice determined, as a rule, both in right ascension and declination, by observations on different nights.

The present volume contains sixty-two zones, comprising between five and six thousand stars, for all of which the reductions have been applied to refer them to the mean equinox for the beginning of the year 1852 or 1853. In the recording of the right ascensions the electro-magnetic method was employed. The following description is given of this process:—

"All the observations of right ascensions have been recorded by the electro-magnetic method, which is perfectly adapted to the wants of the astronomer in a work of this nature. In three most important requisites it has unquestionably the advantage over any of the plans hitherto used,—it is more accurate in its results; it is superior in point of convenience, and in this respect recommends itself to the observer, relieving him from much labour, and contributing to the ease and comparative comfort with which the work can be prosecuted; lastly, the time necessary for completing an observation is greatly shortened, and thus an opportunity is afforded for repetition, or for determining the position of more new objects than could otherwise be included.

"The first step preparatory to the observation of a zone is to place the record-paper on the cylinder of the spring-governor,* and to adjust the galvanic connexions, recording-pen, &c. The equatoreal is then set upon a star, previously selected for the starting point of the zone, of which the right ascension and declination are known; for convenience some bright star is usually chosen. The focal adjustment is now examined, and made to satisfy the condition that the parallax of the image of the star, with reference to the divisions of the scale, should be as nearly as possible eliminated.

"The zero of position of the right-ascension lines is next determined by several passages of a suitable star, and the position circle of the micrometer firmly clamped at the required reading. In this situation the eye-piece has a sliding motion across the scale in the direction of right ascension,—a very useful contrivance, which enables the observer to command the field preceding that which is the immediate scene of observation, and gives time for estimating magnitudes, &c., before the star enters the scale.

"The connexion of the battery with the clock and recording apparatus having been made, and the indications of the barometer and external thermometer read off, the telescope is clamped in right ascension and in declination, so that the zero star shall cross the scale at the reading corresponding to the minutes and seconds of its mean declination for the beginning of the year. As each star approaches the scale, its magnitude is noted, and any peculiarity of appearance, colour, &c., if such are presented. When crossing the scale its declination is read off, and immediately after a signal is given with the break-circuit key in the hands of the observer, which is recorded upon the sheet on the cylinder of the spring-governor. This signal announces the approach of the star to the right-ascension wires; the two passages are noted in succession, occurring at the equator at an interval of four seconds of time. The signal for the instant of their occurrence is given by a tap of the finger on the break-circuit key.

"For every fifth or sixth star the signals are varied by 'breaks' and 'dots,' for which a parallel record is kept in the columns containing the readings of the declination scale; this is done to ensure the identification of the right ascensions and declinations, and to render certain their correct application, each to its proper star.

"Opportunities are taken to note down striking peculiarities in the distribution and number of stars, the nebulæ, clusters, and double stars. In this manner the observer, with the aid of an assistant, whose office is to record the declinations, magnitudes, &c., has it in his power to give the elements of position and magnitude of each star, at the rate of six or seven stars to a minute; the average frequency of observation is about two to a minute. It has been the usual practice not to extend the zone

* For a description of Mr. Bond's recording apparatus see *Monthly Notices*, vol. xi. p. 163.

much beyond the limits of two hours in right ascension. On the following night the observation of the zone is repeated. In this instance the assistant states the magnitude and declination by the previous night's work; the observer has then an opportunity for correcting his last night's results by comparing them with the stars themselves, as they pass the field. The record sheets are now to be read off, and their indications transferred to the note-book in a column opposite to that of the declinations. The counting of the hours, minutes, and seconds on the sheet, is commenced at a point which gives the right ascension of each star differing by a small amount—usually by less than two seconds—from its place referred to the mean equinox for the beginning of the year. The sheet measures twelve inches by twenty. One side of such a sheet is occupied with observations extending over two hours and twenty minutes. The hours and minutes are entered from the side of the sheet, and the seconds from the top."

The *Nautical Almanac* for 1859 has recently been published. Besides the usual quantity of matter, it contains the ephemerides of the small planets for 1856, in the form of a Supplement, as mentioned in the last number of the *Monthly Notices.*

At the meeting of the French Institute, held on the 23d of July, Sir John Herschel was elected one of the eight Foreign Associates of the Institute, in the room of the late M. Gauss.

The Royal Society has awarded the Copley Medal this year to M. Leon Foucault, for his various researches in experimental physics. Of the two Royal Medals one has been awarded to Mr. Hind, for his discovery of ten planetoids, the computation of their orbits, and various other astronomical discoveries; and the other to Mr. J. O. Westwood, President of the Entomological Society, for his various monographs and papers on entomology.

Discovery of a new Comet. By M. Bruhns.

A new comet was discovered by M. Bruhns on the 12th of November, at $15\frac{1}{4}^h$. Shortly afterwards he obtained the following observation of it:—

	Berlin M.T.	App. Comet's R.A.	App. Comet's Decl.
	h m s	° ′ ″	° ′ ″
Nov. 12	17 21 53·3	149 1 25·7	+2 7 15·3

The comet resembles a faint nebula; it has a daily motion in right ascension of about −20′ in arc; and is almost motionless in declination.*

* See the elements of this comet on next page.

Elements of the New Comet discovered by M. Bruhns.

By M. George Rümker.

(*Communicated by Professor Challis.*)

T ..... Nov. 25·66041, 1855, G.M.T.

	°	′	″	
π	85	21	41	App. equinox, Nov. 15.
Ω	52	2	47	
i	10	16	29	

Log q . 0·088070

These elements were computed from observations at Berlin, Nov. 12; Bilk, Nov. 15; and Hamburg, Nov. 20.

ERRATA, VOL. XV.

Page 193, line 13, *for* memoria, *read* memorie.
— 195, — 10, *for* resolveri, *read* resolvere.
— 196, — 15, *for* accidente, *read* accidenti.
— 196, — 22, *for* risposta dei, *read* risposta al.

CONTENTS.

	Page
Fellow elected	1
Account of recent Astronomical Operations in Russia, by M. Otto Struve ...	1
The Positions of 20 Polar Stars, as determined at Redhill, by Mr. Carrington	2
Remarks upon certain Cases of Personal Equation, by the Astronomer Royal	6
On the Theory of Astronomical Refractions, by Sir John W. Lubbock, Bart.	11
Astronomical Diagrams, exhibited by Dr. Drew	14
Note on Comet II., by Dr. Donati	14
Elements of *Fides*, by M. G. Rümker	16
On certain Appearances connected with the Zodiacal Light, by Baron Humboldt	16
Letter on the same subject, by the Rev. George Jones, U.S.N.	18
Notice of "Description of New or Improved Instruments for Navigation and Astronomy," exhibited by Prof. Piazzi Smyth, at the Paris Universal Exposition of 1855	20
Notice of "An Introduction to Practical Astronomy," by Elias Loomis, LL.D.	21
Notice of "Results of Astronomical Observations made at the Observatory of Harvard College," by Prof. Bond	21
Nautical Almanac for 1859	23
Election of Sir John Herschel as Foreign Associate of the French Institute	23
Award of the Royal Society Medals	23
Discovery of a New Comet, by M. Bruhns	23
Elements of the New Comet discovered by M. Bruhns, by M. G. Rümker ...	24

London :—Printed by G. Barclay, Castle St. Leicester Sq.